

Claims

[1] A medical needle extending along a predetermined direction and having a vertical cross-section taken along a plane perpendicular to the predetermined direction of which
5 cross-sectional area varies based upon a distance from a needle tip, the medical needle, comprising:

a plurality of maximal points where the cross-sectional area of the vertical cross-section is locally maximal; and

10 a plurality of minimal points where the cross-sectional area of the vertical cross-section is locally minimal;

wherein the vertical cross-section at the maximal point closest to the needle tip has the cross-sectional
15 area not less than those at any other maximal points.

[2] The medical needle according to Claim 1, further comprising:

at least one channel formed therein extending along
20 the predetermined direction and having at least one opening.

[3] The medical needle according to Claim 2, further comprising:

a holding member connected to a needle rear;
25 wherein the holding member has at least one chamber in

communication with the channel.

[4] The medical needle according to Claim 1, further comprising:

5 at least one groove extending along the predetermined direction.

[5] The medical needle according to Claim 4, further comprising:

10 a holding member connected to a needle rear;
 wherein the holding member has at least one chamber in communication with the groove.

[6] The medical needle according to Claim 1,

15 wherein when viewed on a projected plane parallel to the predetermined direction, the cross-sectional area varies in a linear or curved manner between one of maximal points and the adjacent one of the minimal points.

[7] The medical needle according to Claim 1,

20 wherein the vertical cross-section has a shape selected from a group consisting of triangle, quadrangle, hexagon, polygon, circle, and ellipse.

25 [8] The medical needle according to Claim 1,

wherein the vertical cross-section at the maximal point closer to the needle tip has the cross-sectional area greater than that at another maximal point closer to the needle rear.

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[9] The medical needle according to Claim 1,

wherein the vertical cross-sections at the minimal points have the same cross-sectional area to each other.

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[10] The medical needle according to Claim 1,

wherein the vertical cross-section at the minimal point closer to the needle tip has the cross-sectional area less than that at another maximal point closer to the needle rear.

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[11] The medical needle according to Claim 1,

wherein the cross-sectional area of the vertical cross-section at the minimal point closest to the needle rear is less than those at any other minimal points.

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[12] The medical needle according to Claim 1,

wherein a distance between a pair of the adjacent maximal points is substantially equal to one between another pair of the adjacent maximal points.

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[13] The medical needle according to Claim 1,

wherein a pair of the adjacent maximal points closer to the needle tip is more spaced than another pair of the adjacent maximal points closer to the needle rear.

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[14] The medical needle according to Claim 1, further comprising a grating.

[15] The medical needle according to Claim 1,

10 wherein the needle tip has a radius of curvature of 10 μm or less.

[16] The medical needle according to Claim 1, further comprising a slit extending along the predetermined
15 direction.

[17] The medical needle according to Claim 1,

wherein the medical needle is made of biocompatible material.

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[18] The medical needle according to Claim 1,

wherein the medical needle is made of biodegradable material.

25 [19] A medical needle of biodegradable material extending

along a predetermined direction and having a triangular cross-section taken along a plane perpendicular to the predetermined direction of which cross-sectional area varies based upon a distance from a needle tip,

5 the medical needle comprising:

 a first ascending region of which cross-sectional area monotonically increases as being away from the needle tip;

 a descending region of which cross-sectional area monotonically decreases as being away from the needle tip;

10 and

 a second ascending region of which cross-sectional area monotonically increases as being away from the needle tip;

 wherein the first ascending region, the descending
15 region, and the second ascending region subsequently and integrally formed; and

 wherein the first and second ascending regions have the largest cross-sections with the largest cross-sectional area having substantially the same size and shape to each
20 other.

[20] The medical needle according to Claim 19 further comprising:

 at least one additional descending and ascending
25 regions subsequently and integrally formed of biodegradable

material and connected to the second ascending region.

[21] The medical needle according to Claim 19,

5 wherein a continuous curved portion is provided
between the descending region and the second ascending
region.

[22] The medical needle according to Claim 19, further
comprising:

10 a constant region integrally formed between the
descending region and the second ascending region, of which
cross-sectional area is constant.

[23] The medical needle according to Claim 19, further
15 comprising:

 a holding region of biodegradable material connected
to a needle rear.

[24] The medical needle according to Claim 23, further
20 comprising:

 at least one channel extending along the predetermined
direction within the medical needle.

[25] The medical needle according to Claim 24,

25 wherein the holding region has at least one chamber in

communication with the channel.

[26] The medical needle according to Claim 24,
wherein the channel has at least one opening.

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[27] The medical needle according to Claim 24,
wherein the channel has at least two openings spaced
away from each other by a predetermined gap.

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[28] The medical needle according to Claim 24,
wherein a plurality of the channels are provided, and
wherein the holding region has a plurality of the
chambers, each of the chambers being in communication with
corresponding one of the channels.

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[29] The medical needle according to Claim 24, further
comprising:

at least one groove extending in the predetermined
direction within the medical needle.

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[30] The medical needle according to Claim 24, further
comprising:

a plurality of vertical cavities extending in a
vertical direction perpendicular to the predetermined
direction; and

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a seal membrane of biodegradable material for sealing the vertical cavities;

wherein the seal membrane has the thickness in the vertical direction varying based upon the position of each
5 of the vertical cavities.

[31] A medical needle of biodegradable material extending along a predetermined direction and having a trapezoidal cross-section taken along a plane perpendicular to the
10 predetermined direction of which cross-sectional area varies based upon a distance from a needle tip,

the medical needle comprising:

a first ascending region of which base monotonically increases as being away from the needle tip;

15 a descending region of which base monotonically decreases as being away from the needle tip; and

a second ascending region of which base monotonically increases as being away from the needle tip;

wherein the first ascending region, the descending
20 region, and the second ascending region subsequently and integrally formed;

wherein the first and second ascending regions have the largest base having substantially the same size and shape to each other.

[32] A medical device including a medical needle extending along a predetermined direction and having a vertical cross-section taken along a plane perpendicular to the predetermined direction of which cross-sectional area varies based upon a distance from a needle tip, the medical
5 needle, comprising:

a plurality of maximal points where the cross-sectional area of the vertical cross-section is locally maximal; and

10 a plurality of minimal points where the cross-sectional area of the vertical cross-section is locally minimal;

wherein the vertical cross-section at the maximal point closest to the needle tip has the cross-sectional
15 area not less than those at any other maximal points.